Surgery of Obstructive Urolithiasis in Ruminants

Jennifer M. Ewoldt, DVM, MS[a,*], Meredyth L. Jones, DVM, MS[b], Matt D. Miesner, DVM, MS[c]

KEYWORDS

• Urolithiasis • Urethral obstruction • Cystotomy
• Urethrotomy • Cystostomy • Ruminant

The predisposition to obstructive urolithiasis in male ruminants involves a combination of anatomic and dietary factors. Uroliths in male ruminants most frequently lodge in the distal sigmoid flexure, near the insertion of the retractor penis muscle, or in the vermiform appendage (urethral process) of small ruminants.[1] Both of these are areas of narrowed urethral diameter. Urethral obstruction at these sites may result in local rupture of the urethra or urinary bladder rupture.

Struvite (magnesium ammonium phosphate) and apatite (calcium phosphate) uroliths are commonly seen in animals fed high-grain diets,[2,3] whereas animals consuming legumes are predisposed to calcium carbonate uroliths.[4] Silicate stones may be observed in animals grazing silicaceous plants and soils in the western United States and Canada.[5] Calcium oxalate stones may be associated with oxalate-containing plants.[6]

A significant factor in the availability of urolith components and their binding ability is urine pH.[1,2,7] Struvite, apatite, and calcium carbonate uroliths are known to precipitate in alkaline urine.[2,8–10] Struvite crystallization occurs only at a pH range of 7.2 to 8.4, whereas apatite stones develop at a urine pH of 6.5 to 7.5.[11] Urine pH may have little or no effect on silicate or calcium oxalate uroliths.

Total body water balance plays an important role in calculogenesis by its effects on urine volume and concentration, which may be seen in winter and during times of systemic illness, when water consumption is reduced. A negative body water balance contributes to supersaturation of urine, precipitation of crystals, and formation of organic and inorganic crystalloids in urine.

[a] Scott County Animal Hospital, 115 South 16th Street, Eldridge, IA 52748, USA
[b] Department of Clinical Sciences, 111B Mosier Hall, Kansas State University, Manhattan, KS 66506, USA
[c] Department of Clinical Sciences, College of Veterinary Medicine, Kansas State University, 1800 Dennison Avenue, Manhattan, KS 66506, USA
* Corresponding author.
E-mail address: doctorewoldt@aol.com (J.M. Ewoldt).

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Medical treatment of obstructive urolithiasis in ruminants has generally been unrewarding. Some form of surgical intervention is necessary to relieve the obstruction, either by direct removal of the urolith, or by bypassing the obstruction. Some surgical methods result in loss of urinary continence, some end the ability of intact males to breed, and others have many complications, the most common of which is urethral stricture. Cost is always a factor in the treatment of ruminants, many of which are destined for slaughter.

In this article, medical management of urolithiasis is described briefly, followed by surgical management and preventative measures.

EVALUATION AND MEDICAL TREATMENT

Physical examination of animals suspected to have obstructive urolithiasis should include evaluation of the abdominal contour and the underline, which may be altered because of bladder or urethral rupture, respectively. Palpation of the preputial hairs may reveal blood clots, crystals, or small stones. In obstructed small ruminants, the urethra may pulse ventral to the anal sphincter or on digital rectal examination, and abdominal palpation may detect bladder distension or free abdominal fluid. In cattle, rectal palpation may reveal urinary bladder distension. Transabdominal ultrasound may also confirm free abdominal fluid.

The penis should be exteriorized in obstructed small ruminants, which is facilitated by use of sedatives. Acepromazine (0.05–0.1 mg/kg, intravenous or intramuscular)[12,13] and diazepam (0.1 mg/kg, slow intravenous) provide systemic and muscle relaxation. The use of xylazine should be avoided because it promotes diuraesis and may contribute to rupture if the obstruction is not relieved immediately. Alternatively, lumbosacral epidural using 2% lidocaine (1 mL/7 kg) may be used in the place of sedation in small ruminants to relieve discomfort and aid in exteriorization of the penis.

Once the penis is exteriorized, the urethral process of small ruminants may be amputated (see section on surgical treatment). This narrowing of the urethra is a common site of obstruction in these species and may provide temporary relief of the obstruction. The urethral diverticulum at the level of the ischial arch prevents retrograde passage of a urinary catheter into the urinary bladder (**Figs. 1** and **2**).[14–16] Therefore, retrograde catheterization or retropulsion of uroliths is not recommended to avoid further trauma or puncture of the urethra at the level of the diverticulum. Attempts at retropulsion of uroliths may result in overdistention of the urinary bladder as the stone is diverted into the diverticulum, allowing fluid to pass into the bladder, followed by the urolith falling back into the urethra and preventing the bladder from emptying.

Once the obstruction is relieved, treatments to acidify the urine should be initiated in an effort to solubilize additional stones and sediment. Initially, ammonium chloride is administered at a dosage of 200 mg/kg orally, with the dosage adjusted to attain a urine pH of 6.0 to 6.5. Care should be taken in dosing so that systemic overacidification does not occur.

Fluid therapy should be instituted as indicated by the clinical findings and economics of the case. Intravenous fluid therapy will also help stabilize critical patients before surgical treatment, and reduces the risk for anesthetic death due to hyperkalemia-induced arrhythmia. After relief of the obstruction, diuresis is important to replace dehydration, reduce azotemia, and flush the urinary tract. A good choice for intravenous fluid therapy is 0.9% NaCl, although additional electrolyte and acid-base abnormalities should be considered.